

(2) Each such 25,000 containers or less, successively produced per day, shall constitute a lot and if the test container(s) shall fail, the lot shall be rejected. Otherwise, ten (10) additional containers of each container design produced may be selected at random and subjected to the test. These containers shall be complete with ends assembled. Should any of the containers thus tested fail, the entire lot must be rejected. All containers constituting a lot shall be of like material, size, design construction, finish, and quality.

(c) *Marking.* By means of printing, lithographing, embossing, or stamping, each container must be marked:

(1) DOT-2Q2.

(2) With the name or symbol of the person making the mark. A symbol, if used, must be registered with the Associate Administrator.

[81 FR 3685, Jan. 21, 2016]

Subpart C—Specifications for Cylinders

§ 178.35 General requirements for specification cylinders.

(a) *Compliance.* Compliance with the requirements of this subpart is required in all details.

(b) *Inspections and analyses.* Chemical analyses and tests required by this subchapter must be made within the United States, unless otherwise approved in writing by the Associate Administrator, in accordance with subpart I of part 107 of this chapter. Inspections and verification must be performed by—

(1) An independent inspection agency approved in writing by the Associate Administrator, in accordance with subpart I of part 107 of this chapter; or

(2) For DOT Specifications 3B, 3BN, 3E, 4B, 4BA, 4B240ET, 4AA480, 4L, 8, 8AL, 4BW, 4E, 4D (with a water capacity less than 1,100 cubic inches) and Specification 39 (with a marked service pressure 900 psig or lower), and manufactured within the United States, a competent inspector of the manufacturer.

(c) *Duties of inspector.* The inspector shall determine that each cylinder made is in conformance with the applicable specification. Inspections shall

conform to CGA C-11 (IBR, see § 171.7 of this subchapter) except as otherwise specified in the applicable specification.

(1) *Seamless cylinders.* Seamless cylinders shall be inspected in accordance with Section 5 of CGA C-11. For cylinders made by the billet-piercing process, billets must be inspected and shown to be free from piping (laminations), cracks, excessive segregation and other injurious defects after parting or, when applicable, after nick and cold break.

(2) *Welded cylinders.* Welded cylinders shall be inspected in accordance with Section 6 of CGA C-11. Note: The recommended locations for test specimens are depicted in Figures 1 through 5 in appendix A to subpart C of part 178.

(3) *Non-refillable cylinders.* Non-refillable cylinders shall be inspected in accordance with Section 7 of CGA C-11

(4) *Inspector's report.* The inspector shall prepare a report containing, at a minimum, the applicable information listed in CGA C-11. Any additional information or markings that are required by the applicable specification must be shown on the test report. The signature of the inspector on the reports certifies that the processes of manufacture and heat treatment of cylinders were observed and found satisfactory. The inspector must furnish the completed test reports required by this subpart to the maker of the cylinder and, upon request, to the purchaser. The test report must be retained by the inspector for 15 years from the original test date of the cylinder.

(d) *Defects and attachments.* Cylinders must conform to the following:

(1) A cylinder may not be constructed of material with seams, cracks or laminations, or other injurious defects.

(2) Metal attachments to cylinders must have rounded or chamfered corners or must be protected in such a manner as to prevent the likelihood of causing puncture or damage to other hazardous materials packages. This requirement applies to anything temporarily or permanently attached to the cylinder, such as metal skids.

(e) *Safety devices.* Pressure relief devices and protection for valves, safety

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devices, and other connections, if applied, must be as required or authorized by the appropriate specification, and as required in §173.301 of this subchapter.

(f) *Markings.* Markings on a DOT Specification cylinder must conform to applicable requirements.

(1) Each cylinder must be marked with the following information:

(i) The DOT specification marking must appear first, followed immediately by the service pressure. For example, DOT-3A1800.

(ii) The serial number must be placed just below or immediately following the DOT specification marking.

(iii) A symbol (letters) must be placed just below, immediately before or following the serial number. Other variations in sequence of markings are authorized only when necessitated by a lack of space. The symbol and numbers must be those of the manufacturer. The symbol must be registered with the Associate Administrator; duplications are not authorized.

(iv) The inspector's official mark and date of test (such as 5-95 for May 1995) must be placed near the serial number. This information must be placed so that dates of subsequent tests can be easily added. An example of the markings prescribed in this paragraph (f)(1) is as follows:

DOT-3A1800

1234

XY

AB 5-95

Or;

DOT-3A1800-1234-XY

AB 5-95

Where:

DOT-3A = specification number

1800 = service pressure

1234 = serial number

XY = symbol of manufacturer

AB = inspector's mark

5-95 = date of test

(2) Additional required marking must be applied to the cylinder as follows:

(i) The word "spun" or "plug" must be placed near the DOT specification marking when an end closure in the finished cylinder has been welded by the spinning process, or effected by plugging.

(ii) As prescribed in specification 3HT (§178.44) or 3T (§178.45), if applicable.

(3) *Marking exceptions.* A DOT 3E cylinder is not required to be marked with an inspector's mark or a serial number.

(4) Unless otherwise specified in the applicable specification, the markings on each cylinder must be stamped plainly and permanently on the shoulder, top head, or neck.

(5) The size of each marking must be at least 0.25 inch or as space permits.

(6) Other markings are authorized provided they are made in low stress areas other than the side wall and are not of a size and depth that will create harmful stress concentrations. Such marks may not conflict with any DOT required markings.

(7) *Marking exceptions.* A DOT 8 or 8AL cylinder is not required to be marked with the service pressure.

(8) *Tare weight or mass weight, and water capacity marking.* DOT-specification 4B, 4BA, 4BW, and 4E cylinders used in liquefied compressed gas service manufactured after December 28, 2022, must be marked with the tare weight or mass weight. Additionally, the cylinder must be permanently marked with the water capacity. The owner of the cylinder must ensure it is marked with the following information, as applicable:

(i) *Tare weight.* The tare weight for a cylinder 25 pounds or less at the time of manufacture, with a lower tolerance of 3 percent and an upper tolerance of 1 percent; or for a cylinder exceeding 25 pounds at the time of manufacture, with a lower tolerance of 2 percent and an upper tolerance of 1 percent. The tare weight marking must be the actual weight of the fully assembled cylinder, including the valve(s) and other permanently affixed appurtenances. Removable protective cap(s) or cover(s) must not be included in the cylinder tare weight. Tare weight shall be abbreviated "TW"; or

(ii) *Mass weight.* The mass weight for a cylinder 25 pounds or less at the time of manufacture, with a lower tolerance of 3 percent and an upper tolerance of 1 percent; or the mass weight marking for a cylinder exceeding 25 pounds at the time of manufacture, with a lower tolerance of 2 percent and an upper tolerance of 1 percent. The mass weight marking must be the actual weight of the fully assembled cylinder, excluding

valve(s) and removable protective cap(s) or cover(s). Mass weight shall be abbreviated "MW"; and

(iii) *Water capacity.* The water capacity for a cylinder 25 pounds water capacity or less, with a tolerance of minus 1 percent and no upper tolerance; or for a cylinder exceeding 25 pounds water capacity, with a tolerance of minus 0.5 percent and no upper tolerance. The marked water capacity of the cylinder must be the capacity of the cylinder at the time of manufacture. Water capacity shall be abbreviated "WC".

(g) *Manufacturer's reports.* At or before the time of delivery to the purchaser, the cylinder manufacturer must have all completed certification documents listed in CGA C-11. The manufacturer of the cylinders must retain the reports required by this subpart for 15 years from the original test date of the cylinder.

[Amdt. 178-114, 61 FR 25942, May 23, 1996, as amended at 66 FR 45185, Aug. 28, 2001; 67 FR 51652, Aug. 8, 2002; 68 FR 75748, Dec. 31, 2003; 76 FR 43531, July 20, 2011; 83 FR 55810, Nov. 7, 2018; 85 FR 75716, Nov. 25, 2020; 85 FR 85419, Dec. 28, 2020]

§ 178.36 Specification 3A and 3AX seamless steel cylinders.

(a) *Type size and service pressure.* In addition to the requirements of § 178.35, cylinders must conform to the following:

(1) A DOT-3A cylinder is a seamless steel cylinder with a water capacity (nominal) not over 1,000 pounds and a service pressure of at least 150 psig.

(2) A DOT-3AX is a seamless steel cylinder with a water capacity not less than 1,000 pounds and a service pressure of at least 500 psig, conforming to the following requirements:

(i) Assuming the cylinder is to be supported horizontally at its two ends only and to be uniformly loaded over its entire length consisting of the weight per unit of length of the straight cylindrical portion filled with water and compressed to the specified test pressure; the sum of two times the maximum tensile stress in the bottom fibers due to bending, plus that in the same fibers (longitudinal stress), due to hydrostatic test may not exceed 80 percent of the minimum yield strength of

the steel at such maximum stress. Wall thickness must be increased when necessary to meet the requirement.

(ii) To calculate the maximum longitudinal tensile stress due to bending, the following formula must be used:

$$S = Mc/I$$

(iii) To calculate the maximum longitudinal tensile stress due to hydrostatic test pressure, the following formula must be used:

$$S = A_1 P/A_2$$

where:

S = tensile stress—p.s.i.;

M = bending moment—inch pounds— $(wl^2)/8$;

w = weight per inch of cylinder filled with water;

l = length of cylinder—inches;

c = radius (D)/(2) of cylinder—inches;

I = moment of inertia— $0.04909 (D^4 - d^4)$ inches fourth;

D = outside diameter—inches;

d = inside diameter—inches;

A₁ = internal area in cross section of cylinder—square inches;

A₂ = area of metal in cross section of cylinder—square inches;

P = hydrostatic test pressure—psig.

(b) *Steel.* Open-hearth or electric steel of uniform quality must be used. Content percent may not exceed the following: Carbon, 0.55; phosphorous, 0.045; sulphur, 0.050.

(c) *Identification of material.* Material must be identified by any suitable method, except that plates and billets for hot-drawn cylinders must be marked with the heat number.

(d) *Manufacture.* Cylinders must be manufactured using equipment and processes adequate to ensure that each cylinder produced conforms to the requirements of this subpart. No fissure or other defect is permitted that is likely to weaken the finished cylinder appreciably. A reasonably smooth and uniform surface finish is required. If not originally free from such defects, the surface may be machined or otherwise treated to eliminate these defects. The thickness of the bottoms of cylinders welded or formed by spinning is, under no condition, to be less than two times the minimum wall thickness of the cylindrical shell; such bottom thicknesses must be measured within an area bounded by a line representing